DETAILED ACTION

Continued Examination

1. Claims 1, 3-7 and 9-37 are pending in the application.

2. Additional grounds of rejection have been introduced for claim 37.

3. In response to applicant's telephone inquiry on 12/9/2010 regarding the last Office action dated 11/26/2010, the following corrective action is taken.

The period for reply of 3 MONTHS set in said Office Action is restarted to begin with the mailing date of this letter.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1, 3-6, 9-13, 18, 20-22, 26, 31, 35 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084).

Regarding claim 1, Callahan et al. discloses an ionic conduction material comprising a polymer matrix ([0020]), at least one ionic species ([0020]) and at least one reinforcing agent ([0064]), wherein:

- the polymer matrix ([0020]) is a solvating polymer ([0021]) optionally having a polar character (“charge transfer compounds”, [0065]);

- the ionic species ([0020]) is an ionic compound selected from salts and acids ([0064]), said compound being in solution ([0064]) in the polymer matrix ([0020]);
- the reinforcing agent is a cellulosic material ([0064]).

Callahan et al. does not disclose the reinforcing material is comprised of cellulose single crystals or of cellulose microfibrils nor that the polymer matrix is comprised of a solvating polymer having a polar character and wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Leesona discloses a support for an electrode (P5/C1/L35-37) including cellulosic (P3/C1/L5-7) microfibers (P4/C1/L45-48) brought into contact with (P3/LC1/L5-39) a polymer matrix including a charge (P2/C1/L55-60) forming a reinforcing network enhancing the mechanical strength and overall construction of an electrode (P1/C1/L39-41, P5/C1/L35-37).

Leesona and Callahan et al. are analogous since both deal in the same field of endeavor, namely, polymer materials for electrodes.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the cellulosic microfibers in contact with a polymer matrix as disclosed by Leesona into the material composition of Callahan et al. to enhance the mechanical strength and overall construction of an electrode onto which the material composition is disposed.

Regarding claim 3, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the proportion of reinforcing agent is between 0.5% and 70% by weight ([0064]).

Regarding claim 4, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the proportion of reinforcing agent is between 1% and 10% by weight ([0064]).

Regarding claim 5, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the polymer matrix is comprised of a crosslinked ([0021]) or non-crosslinked solvating polymer ([0021]).

Regarding claim 6, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the solvating polymer ([0021]) carries grafted ionic groups ([0054], [0055], [0056]).

Regarding claim 9, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the polymer matrix ([0020]) is comprised of a mixture of solvating ([0021]) polymers and at least one aprotic polar liquid (“unsaturated amide”, [0063]).

Regarding claim 10, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the aprotic polar liquid (“unsaturated amide”, [0063]) is an amides ([0063]).

Regarding claim 11, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the polymer is a non-solvating polymer selected from the .qroup consistinq of polymers which have polar groups (“anionic polysulfone”, [0064]) and which comprise units containing at least one heteroatom containing sulfur ([0064]).

Regarding claim 12, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the ionic compound is selected from the qroup consistinq_of strong acids (“perchloric acid”, [0027]) and from salts of alkali metals (“KOH”, [0077]).

Regarding claim 13, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the ionic compound is selected from the qroup consistinq of phosphoric acid (“perchloric acid”, [0027]), and from salts of said acids ([0064]).

Regarding claim 18, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses an electronically conductive material (“conductive

glass”, [0029]) and an active material (“platinum”, [0044]) performing as a catalyst (“inert”, [0044]).

Regarding claim 20, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the active material is platinum ([0044]) or a platinum alloy.

Regarding claim 21, modified Callahan et al. discloses an electrode for a fuel cell ([0022]), comprising a composite material ([0044]) as set forth above.

Regarding claim 22, modified Callahan et al. discloses an electrolyte for a lithium-polymer battery ([0042]), in which the negative electrode (“anode”, [0043]) is comprised of metallic lithium ([0043]), and a material ([0046]) as set forth above.

Regarding claim 26, modified Callahan et al. discloses an electrolyte of a membrane fuel cell ([0022]), comprised of an ionic conduction material ([0020]) as set forth above.

Regarding claim 31, modified Callahan et al. discloses an electrochromic glazing ([0016]) comprising two electrodes ([0017]) separated by an electrolyte ([0017]), wherein the electrolyte is an ionic conduction material ([0020]) as set forth above in which the ionic compound is an acid ([0021]).

Regarding claim 35, modified Callahan et al. discloses an electrode for a fuel cell ([0022]), comprising a composite material ([0020]), wherein the composite material ([0020]) is a material as set forth above.

Regarding claim 37, modified Callahan et al. discloses all of the claim limitations as set forth above. Further regarding limitations recited claim 37, which are directed to method of making said cellulosic material (e.g. "cellulosic material obtained from…") it is noted that said limitations are not given patentable weight in the product claims. Even though a product-by-process is defined by the process steps by which the product is made, determination of patentability is based on the product itself and does not depend on its method of production. *In re Thorpe*, 777 F.2d 695, 227 USPQ 964 (Fed. Cir. 1985). As the court stated in Thorpe, 777 F.2d at 697, 227 USPQ at 966 (The patentability of a product does not depend on its method of production. In re Pilkington, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969). If the product in a product-by-process claim is the same or obvious as the product of the prior art, the claim is unpatentable even though the prior art product was made by a different process.). See MPEP 2113 and 2114. Therefore, since the cellulosic material as recited in claim 37 is the same as the cellulosic material disclosed by modified Callahan et al., as set forth above, the claim is unpatentable even though the cellulosic material of modified Callahan et al. was made by a different process. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983).

6. Claims 7, 23, 27-28 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084) as applied to claim 1 above and further in view of Armand et al. (US 2002/0013381).

Regarding claims 7 and 27-28, Callahan et al. discloses all of the claim limitations as set forth above but does not disclose polymer matrix is comprised of a non- solvating polymer carrying acidic ionic groups, wherein the non-solvating polymer carries alkylsulfonic groups or arylsulfonic groups or perfluorosulfonic groups or perfluoro-carboxylic groups.

Armand et al. discloses a battery electrode ([0058]) comprising a polymer matrix including an acidic non-solvating polymer ([0054]) carrying alkyl sulfur-containing groups ([0054]) that forms a network ([0055]) with other materials enhancing the mechanical properties of the structure onto which the polymer matrix material is used ([0061], [0108]).

Armand et al. and Callahan et al. are analogous since both deal in the same field of endeavor, namely, polymer materials for electrodes.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the non-solvating polar polymer forming a reinforcing network with other materials as disclosed by Armand et al. into the composition of Callahan et al. to enhance the mechanical properties of the composition and therefore enhance the structure onto which the composition is disposed.

Regarding claim 23, Callahan et al. discloses all of the claim limitations as set forth above but does not disclose the polymer matrix of the ionic conduction material is comprised of an amorphous one-dimensional copolymer or of an amorphous three-dimensional polyether network.

Armand et al. discloses a polymer matrix material comprised of an amorphous one-dimensional copolymer ([0076]). Polyethylene oxide is a one-dimensional copolymer as evidenced by Simon et al. ("Crystallization and Melting Behavior of Polyethylene Oxide Copolymers", Abstract/P82). This material acts to enhance the mechanical properties of the structure onto which the polymer matrix material is used ([0061], [0108])

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the amorphous one-dimensional copolymer of Armand et al. into the material of Callahan et al. to enhancing the mechanical properties of the structure onto which the polymer matrix material is used.

Regarding claim 36, modified Callahan et al. discloses all of the claim limitations as set forth above but does not disclose the reinforcing agent is brought into contact with the polymer in solution or in the form of a laytex in suspension, or with precursors of the polymer.

Armand et al. discloses a battery electrode ([0058]) comprising a polymer matrix including a polar solvating polymer ([0055]) that forms a network ([0055]) with polymer precursors ([0041]-[0043]) enhancing the mechanical properties of the structure onto which the polymer matrix material is used ([0061], [0108]).

Armand et al. and Callahan et al. are analogous since both deal in the same field of endeavor, namely, polymer materials for electrodes.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the solvating polar polymer forming a reinforcing network polymer precursors as disclosed by Armand et al. into the composition of Callahan et al. to enhance the mechanical properties of the composition and therefore enhance the structure onto which the composition is disposed.

7. Claims 14-17, 19, and 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084) as applied to claims 1 and 18 above and further in view of Hirakawa et al. (5,281,495).

Regarding claims 14 – 15, and 19, Callahan et al. discloses all of the claim limitations as set forth above and also discloses an insertion material ([0048]), but does not disclose an electronically conductive material in addition to the disclosed insertion material.

Hirakawa et al. discloses a rechargeable battery (Abstract) comprising electrodes with conductive layers in the form of carbon powder (C5/L29-30) and active (insertion) layers (C4/L5-12). The conductive layers help improve cell and cycle characteristics (C3/L55-57).

Hirakawa et al. and Callahan et al. are analogous since both deal in the same field of endeavor, namely, materials used in electrochemical cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include carbon powder as a conductive material as disclosed by Hirakawa et al. into the ionic conductive material of Callahan et al. to improve cell and cycle characteristics of the electrical device into which the material is disposed of.

Regarding claim 16, modified Callahan et al. discloses all of the claim limitations as set forth above and also discloses the insertion material ([0048]) is an oxide manganese ([0048]).

Regarding claim 17, 32 and 33, modified Callahan et al. discloses an electrode for a battery ([0022]), comprisinq a composite material ([0020]), wherein the composite material ([0020]) is a material as set forth above.

Regarding claim 34, modified Callahan et al. discloses an electrode for a fuel cell ([0022]), comprising a composite material ([0020]), wherein the composite material ([0020]) is a material as set forth above.

8. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084) as applied to claim 1 above and further in view of Tossici et al. (US 6,087,043).

Regarding claim 24, Callahan et al. discloses all of the claim limitations as set forth above and discloses an electrolyte for a lithium-polymer battery ([0022]), but does not disclose the negative electrode consists of lithiated graphite, and a material as set forth above.

Tossici et al. discloses lithium-polymer battery (Abstract) comprising a negative electrode (“anode”, C4/L12) containing a lithiated graphite (C14/L13-14) and an ionic conductive polymer (C6/L9-10). Batteries containing these electrodes have high energy densities compared to conventional batteries (C1/L54-56).

Tossici et al. and Callahan et al. are analogous since both deal in the same field of endeavor, namely, batteries.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the ionic conductive material of Callahan et al. into a lithiated graphite battery as disclosed by Tossici et al. to impart a high energy density into the battery, enhancing performance.

Regarding claim 25, modified Callahan et al. discloses all of the claim limitations as set forth above but does not disclose the matrix of the ionic conduction polymer is comprised of a homo- or copolymer of vinylidene fluoride, acrylonitrile, methacrylonitrile, alkyl acrylate, alkyl methacrylate or ethylene oxide.

Tossici et al. discloses an ionic conductive polymer binder, vinylidene fluoride (C6/L9-10), is used in an electrode. This material binds the active material to a

substrate (C6/L11-14). Batteries containing these electrodes have high energy densities compared to conventional batteries (C1/L54-56).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate vinylidene fluoride as a binder as disclosed by Tossici et al. into the material of Callahan et al. to bind the active material to the electrode and impart a high energy density into the battery.

9. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084) as applied to claim 1 above and further in view of Skotheim (US 4,442,185).

Regarding claim 29, Callahan et al. discloses all of the claim limitations as set forth above and that the ionic conductive material can be used in a variety of electrochemical devices ([0003]), but does not explicitly disclose a solar cell comprising a photoanode and a cathode separated by electrolyte, the photoanode carrying a conductive glass, wherein the electrolyte is comprised of an ionic conduction material as set forth above.

Skotheim discloses in Fig 1, a solar cell (Abstract) comprising a photoanode (ref 5) and a cathode (ref 6) separated by electrolyte (ref 3), the photoanode carrying a conductive glass (C16/L21-22), wherein the electrolyte (ref 3) is comprised of ionic polymer matrix material (C14/L31-32) containing cellulose (C14/L64).

Skotheim and Callahan et al. are analogous since both deal in the same field of endeavor, namely, electrochemical cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the ionic conductive material of Callahan et al. into a solar cell as disclosed by Skotheim to generate electrochemical energy to power electrical devices.

10. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084) as applied to claim 1 above and further in view of Niu (US 6,205,016).

Regarding claim 30, Callahan et al. discloses all of the claim limitations as set forth above and that the ionic conductive material can be used in a variety of electrochemical devices ([0003]), but does not explicitly disclose a supercapacitor comprised of an electrochemical cell comprising two electrodes separated by an electrolyte, wherein the electrolyte is an ionic conduction material as set forth above in which the ionic compound is a lithium or tetraalkylammonium salt, or an acid.

Niu discloses supercapacitor (C3/L36) comprised of an electrochemical cell (C9/L37-38) comprising two electrodes separated by an electrolyte (C9/39/40), wherein the electrolyte is an ionic ionic polymer matrix material (C17/L16-17) in which the ionic compound is a lithium or tetraalkylammonium salt (C9/L42), or an acid.

Niu and Callahan et al. are analogous since both deal in the same field of endeavor, namely, electrochemical cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the ionic conductive material of Callahan et al. into a

supercapacitor as disclosed by Niu to generate electrochemical energy to power electrical devices.

11. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Leesona (GB 1,160,084) as applied to claim 1 above and further in view of Miller (US 3,798,032).

Regarding claim 37, modified Callahan et al. discloses all of the claim limitations as set forth above but does not disclose the cellulosic material is obtained from sugar beet residues.

Miller discloses a polymeric material for an electroconductive coating for an electrical application (C1/L25) including a film-forming polymer capable of forming a continuous self-supporting film (C5/L41-48), the self supporting film formed from sugar beet material (C5/L25). This configuration enhances the electroconductivity of the coating (C1/L4-5).

Miller and Callahan et al. are analogous since both deal with materials used in electrical applications.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the sugar beet material disclosed by Miller into the composition of Callahan et al. to enhance the conductivity of the material.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENNETH DOUYETTE whose telephone number is (571)270-1212. The examiner can normally be reached on Monday - Thursday 6am - 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KENNETH DOUYETTE/
Examiner, Art Unit 1725

/Jonathan Crepeau/
Primary Examiner, Art Unit 1725